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Construction Project Management: Project Formulation and Appraisal — Guidelines

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Construction Management (Including Safety in Construction) Sectional Committee had been approved by the Civil Engineering Division Council.

A construction project is an endeavour undertaken by a project team on behalf of owner/client to create a built facility suited to the defined functional objectives. From inception to commissioning, the project goes through various distinct stages leading to progressive achievement of the project objectives. Each stage involves specific inputs, processes (both technical and managerial) and deliverables. Typically, the life cycle of a project from inception to completion involves the following stages:

a) *Project formulation and appraisal* — Inception, feasibility, appraisal and strategic planning;
b) *Project development* — Project brief development, planning and design, finalization of project proposals, procurement strategy, construction documentation including tender drawings, construction drawings, specifications, cost estimates, bill of quantities, procurement documents;
c) *Planning for construction* — Sequencing of project components, planning tools, resource planning and time cost trade off;
d) *Tender action* — Open competitive bidding/pre-qualification of agencies, issue of tender documents, evaluation of bids, negotiation if required and award of work;
e) *Construction* — Execution, monitoring, control, work acceptance; and
f) *Commissioning and handing over* — Contractual closeout, financial closeout, defect liability commencement, facility handing over.

The distinct features of a construction project include the temporary nature of the project team involved, the evolutionary process of the project deliverables during project development stages and the unique output as the built facility. As a result of these features, unless there is efficient and effective project management, a construction project is faced with challenges of uncertainties leading to time over-runs, cost over-runs, changes in project parameters, loss of quality and inability to meet the functional objectives. While technical soundness of a project proposal is an important aspect of a construction project, the management aspects, which involve techno-legal, financial and other issues, have also a significant role in the success of a project. Therefore, management functions and technical processes in a construction project need to be integrated towards achieving project objectives. Top management commitment plays an important role in harmoniously achieving these project objectives. In some of the public domain projects, it may be necessary to share relevant information with public at large through appropriate means.

To provide necessary guidance on effective construction project management a series of standards have been developed as a part of IS 15883 'Guidelines for construction project management', the scopes of which cover the stages subsequent to the stage of approval, when a decision to implement a project, including its financing, is taken. However, for successful management of construction projects, the earlier stages when the construction project is conceived, formulated and its feasibility assessed, leading to decision to implement the project, are equally important.

This standard covers guidelines for project formulation and appraisal aspects of construction project management and covers activities for the same up to the stage of preparation of proposals for obtaining approval for implementing the project including financial approval. It does not cover the stages subsequent to the stage of financial approval, when a decision to implement the project including its financing is taken, which are covered in IS 15883 (Part 1): 2009 'Guidelines for construction project management : Part 1 General' and in its other parts.

The guidelines may be applicable in general in all construction projects. However, for smaller projects, the applicability of various provisions may be decided appropriately by the parties concerned.

The composition of the Committee responsible for formulation of this standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the resultof a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that specified value in this standard.

Indian Standard

CONSTRUCTION PROJECT MANAGEMENT: PROJECT FORMULATION AND APPRAISAL — GUIDELINES

(Third Revision)

1 SCOPE

1.1 This standard covers guidelines for project formulation and appraisal aspects of construction project management.

1.2 This standard covers aspects of project formulation and appraisal up to the stage of preparation of proposals for obtaining approval for implementing the project including financial approval. It does not cover the stages subsequent to the stage of financial approval, when a decision to implement the project including its financing is taken which are covered in IS 15883 (Parts 1 to 8).

1.3 The provisions of this standard are to be read in conjunction with IS 15883 (Parts 1 to 8).

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
7337 : 1985	Glossary of terms in project network analysis
10400 : 1992	Glossary of terms in inventory control
15198 : 2002	Glossary of terms in human resource development
15883	Construction project management—
(Part 1) : 2009	Guidelines : General
(Part 2) : 2013	Time management
(Part 3) : 2015	Cost management (*under print*)
(Part 4) : 2015	Quality management (*under print*)
(Part 5) : 2013	Health and safety management
(Part 6) : 2015	Scope management (*under print*)
(Part 8) : 2015	Risk management (*under print*)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 7337, IS 10400 and IS 15198 and the following shall apply.

3.1 Project Formulation — It is systematic development of an idea, a need or an opportunity into a project proposal, outlining the project scope and objectives of the proposed project to be completed within the requirements of time, cost, quality, safety, etc.

3.2 Project Appraisal — It is the process of critically assessing and reviewing project proposals by validating the assumptions, conducting the necessary technical, and physical and financial feasibility studies before decision to implement the project is taken.

4 GENERAL

4.1 Overview of Project Formulation and Project Appraisal

A construction project is generally a non-recurring unique task having a definable beginning and end with a definite mission and a set of objectives to be achieved for creating the required facility. It is an endeavour undertaken by a project team on behalf of owner/client to create either a new facility or upgrade an existing facility suited to the defined functional objective. This also includes additions/alterations of existing facilities.

Construction project formulation deals with assessing scope and requirements of the project meeting the client's needs while meeting with environmental impact assessment (EIA), and sustainability aspects.

Project appraisal involves checking of the basic data, assumptions and methodology used in project formulation; assessing techno-economic feasibility; review of the work plan, cost estimates and proposed financing, an assessment of the project's organizational and management aspects; project risk assessment; and finally the viability of the project.

Project objectives may be defined in terms of scope, time, cost, quality, safety and security requirements. These objectives serve as guiding factors in project formulation and appraisal stage. For the purpose of this standard, project formulation and appraisal objectives cover the preliminary stages, that is, inception, prefeasibility, feasibility, related project strategic planning and viability assessment and review prior to approval of project.

A flow chart depicting various broad stages in the process of project formulation and appraisal is given in Fig.1.

NOTE — A detailed flow chart is given at Fig. 2.

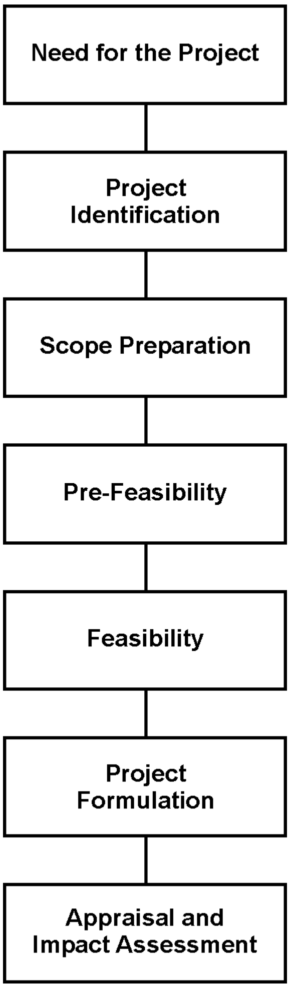


FIG.1 FLOW CHART FOR PROJECT FORMULATION AND APPRAISAL

4.2 Need for Construction Project Formulation and Appraisal

Project formulation is necessary to frame the outline of the proposed project including the scope of the work involved, its duration, the preliminary costs involved, quality assurance as well as its viability so as to achieve the objectives of the owner/client. In order to ensure that a construction project meets its objectives, the proposal has to be based on reliable field data, proper assessment of financial and other resources requirements keeping in view the size, location, working environment of the project, etc.

The appraisal by the owner/client is necessary for a review whether the basic assumptions have sound grounds and proposed proposal meets with the intended objectives and requirements; the cost indicated is reasonable and can be financed with the resources available; and the aspects of time, quality, sustainability; and other relevant items are taken care of.

4.3 Organization Structure for Project Formulation and Appraisal

The owner/client is primarily concerned with overall project formulation and appraisal and is required to coordinate from project inception to project formulation and subsequent project appraisal. In the process, various studies may have to be undertaken and coordination needs to be done with various input providers, customers, statutory bodies, appraising agencies, funding organizations, project affected people, etc.

NOTE — Where there is more than one owner/client, the term owner/client shall mean the organizations representing them.

The owner/client may get the entire work carried out in-house, or partly in-house and the remaining from other specialized agencies, or the entire work may be outsourced. Various items of work may be carried out as follows:

a) *Project inception* — Generally, the preliminary work to start with project formulation is carried out in-house. However, in some cases decision is taken by the owner based on the ground work and studies done by a consultant(s). Broad scope and objectives of the project are defined by the owner/client.

b) *Project formulation*:

   1) *Preparation of pre-feasibility report* — This may be carried out in-house and/or through a consultant. In the case of outsourcing, supervision is generally done in-house.

   2) *Undertaking various studies* — This may be carried out in-house and/or through a consultant. In the case of outsourcing, supervision is done in-house.

   3) *Feasibility report* — This may be carried out in-house and/or through a consultant. In the case of outsourcing, supervision is done in-house.

   4) *Coordination with external agencies* — This may be carried out in-house and/or through a consultant.

   5) *Project appraisal* — It is done by the owner and/or wherever required, by specialized agencies well-experienced in such work, appointed by owner or funding agencies. Owner/client shall take the final decision to proceed with the project.

To carry out above items, appropriate organizational structure is required for construction project formulation and appraisal, as follows:

i) *Organizational structure of owner for,*
   a) works to be carried out in-house, and
   b) co-ordination with and supervision of work of consultants as per agreements entered with them.

ii) *Organizational structure of consultants, to fulfill their commitment as per agreements entered into by them for,*
   a) works to be carried out in-house by consultants, and
   b) works to be carried out by consultants through sub-consultants and supervision thereof.

The organizational structure for carrying out various activities related with project formulation and appraisal may vary from project to project depending upon their size and complexities. For large and medium value projects, it may be necessary to have separate team within the organization or work may be entrusted to an experienced consultant in the field. If considered expedient, work of project formulation and/or appraisal may be got done through combination of in-house expertise and consultants. In small size projects these functions may be entrusted to existing functionaries.

Typical organizational charts for these activities to be taken up through in-house and outsourced teams are given in Annex A and may be modified to suit the needs of organizations and projects.

5 PROJECT FORMULATION

5.1 General Approach

5.1.1 The project formulation shall start after the need of the project has been established. Interactions shall be held with the owner/client and stakeholders to assess and appreciate their requirements. The project specific site data shall be collected and assessment with respect to availability of land, finance and connectivity and all required services such as water supply, electricity, drainage and sewerage, etc, and other resources shall be made.

The project proposal formulator shall ensure that the proposal summarizes the project rationale and design, and the same is communicated in very clear and precise manner.

5.1.2 Project formulation shall incorporate the following:

a) *Project context*, comprising project origin, relevance, conformity with owners/client's objectives and priorities, relevance to the owner/client's policies, description of the target beneficiaries, and expected outcomes on project completion.

b) *Project rationale and objectives*, comprising stakeholder analysis, problem analysis, logical framework and specific objectives.

c) *Description of project parameters,* comprising of scope of project, outputs related activities, implementation approaches and methods, work plan, budget, assumptions, risks and sustainability.

d) *Implementation arrangements*, comprising organization structure and stakeholder involvement mechanisms, reporting, reviewing, monitoring and evaluation, dissemination of project details.

5.2 Types of Project Proposals

Projects may be broadly classified into following categories based on type of work, duration, project value and required pace of execution of project:

a) With respect to type of work, construction projects may be categorized as:
   1) Building projects,
   2) Infrastructure projects,
   3) Industrial projects, and
   4) Other projects.

b) With respect to project completion time, projects may be categorized as:
   1) Long duration projects (over 5 years),
   2) Medium duration projects (3 to 5 years),
   3) Short duration projects (1 to 3 years), and
   4) Special short term projects (less than 1 year).

c) With respect to project value, projects may be categorized as:
   1) Mega value projects,
   2) Large value projects,
   3) Medium value projects, and
   4) Small value projects.

   NOTE — The value depends upon the sector concerned.

d) With respect to speed of project execution, projects may be categorized as:
   1) Fast track projects, and
   2) Normal pace projects.

5.3 Factors Affecting Project Formulation

Project formulation proposals may take into account the following factors:

a) Relevance to the objectives of the owner/client;

b) Technical soundness;
c) Environmental impact;
d) Economic aspects and funding requirements;
e) Project financing;
f) Cost-effectiveness;
g) Sustainability of the project;
h) Scope for future expansion;
j) Social and political aspects;
k) Legal aspects; and
m) Ethics.

5.4 Stages

5.4.1 Every project has certain stages during its formulation before it is approved for implementation. These stages provide a framework for clear understanding of resource allocation, scheduling project milestones for implementation, and subsequently establishing a monitoring system. Various stages during project formulation and associated activities are as follows:

a) *Need for the project* — This stage involves inception of idea, and establishment of project need through 'need analysis' keeping in view the existing facilities, demands and development goals.

b) *Project identification* — This is the stage of the project formulation when an idea is evaluated and potential project proposals are identified. The purpose is to establish the basic objectives of the project and identify the priority of the project. Tools used are problem analysis, objectives setting and strategy.

c) *Scope preparation* — The project scope establishes the type of works that need to be completed to deliver a product, service or a result with specified features and functions. It is the boundary of a project within which all activities in the project are required to be executed. Since the scope forms the basis of a project defining requirements and boundaries of work, it needs to be defined, in measurable parameter, without any ambiguity to avoid subsequent deviations and unnecessary work. It could accommodate minor variations that may arise during project execution.

The purpose of scope preparation of proposed work is to achieve clarity of the project scope, including objectives and deliverables. It forms basis of the project formulation and has to be not only clearly defined but should be based on well thought out decisions in consonance with the detailed requirements of the owner/client so that substantial changes in the scope at later stages are obviated.

The concepts of projects identified are refined and elaborated further and components are examined in detail to see, if these merit prefeasibility studies and feasibility studies. Problems proposed to be solved, main beneficiaries, overall objectives and benefits to be derived, need to be clearly stated.

d) *Availability of land* — Land is the single most important factor, without availability of which, the process of project formulation will be incomplete. A detailed survey of land has to be carried out before deciding upon the location and acquiring land. Following aspects pertaining to land need to be investigated and clearly brought out in the draft project formulation report:

1) *Description of land and its suitability* — A brief description of the land required for the project including a plan(s) showing its location and detailed study of suitability of the land for the project. Whether the land is suitable for taking up the proposed construction project, that is, with reference to services, availability of materials and other resources, geotechnical investigations, etc.

2) *Status of availability of land* — Whether the land is available or is to be acquired.

3) *Issues affecting utilization of land*:

i) Encumbrance of any religious buildings, graveyards or monuments on the land, trees, wells, etc.
ii) Existence of HT/LT lines over land rendering part of area unfit for development.
iii) Restrictions on utilization of land, if any.
iv) Disputes pending settlement.
v) Cultivation status of land.
vi) Absence of clear title to land.
vii) Land acquisition clearance.
viii) Environmental issues.
ix) Social issues.
x) Permissible land use.
xi) Encroachments and other encumbrances.

4) *Cost of land* — Information in respect of,

i) Cost already incurred.
ii) Further cost anticipated.
iii) Status of approvals required from government/local authorities for taking up the type of construction proposed on this land, including environmental clearance.

5) *Other relevant issues*:
   - i) Approach to land/connectivity of land including its distance from nearest railway station/airport/bus stand.
   - ii) Availability of basic infrastructure in vicinity.
   - iii) Whether the land is freehold or leasehold.
   - iv) Legal clearance of title for land.
   - v) Mutation of land in favour of owner/client
   - vi) Proper demarcation of land.
   - vii) Existing trees on land.
   - viii) Details of nearby properties.
   - ix) Whether the land is contiguous.
   - x) Any contamination of land.

e) *Prefeasibility study* — This is the first attempt to examine the overall potential or viability of the project. The data and information gathered at the scope preparation stage are used also taking into account the local survey and preliminary investigations. The existing reports on the data and studies of similar projects in similar location in past, if any, shall be incorporated in the report. This is the stage for completing all the preliminary steps for going into a detailed feasibility exercise.

The prefeasibility stage should normally comprise the following aspects:

1) Demand and supply,
2) Availability of suitable land,
3) Technical or engineering requirements,
4) Environmental impact,
5) Manpower and administrative support,
6) Socio-economic viability, and
7) Financial aspects.

A conscious decision needs to be taken after prefeasibility study whether next stage of feasibility study should be ventured into. Only if the outcome of modules mentioned above indicates positive results, the next stages should be considered for taking up.

f) *Feasibility study*:

1) The project is examined to see, if it shows promise of meeting the financial, economic, environmental, sustainability and social criteria that has been set for investment expenditure. Engineering investigations and detailed studies are carried out at this stage and the conclusion can be that the project is feasible or not feasible. The feasibility report will encompass following aspects and will form the basis for taking a decision whether to go in for detailed proposal or not by evaluating internal and external constraints.

2) The feasibility study shall comprise the following:
   - i) Scope of the project,
   - ii) Proposed approach and methodology,
   - iii) Demand and supply gap study,
   - iv) Review of past studies, reports and data,
   - v) Inventory of existing assets,
   - vi) Infrastructure availability,
   - vii) Material and engineering investigations,
   - viii) Approvals required,
   - ix) Sustainability,
   - x) Time frame,
   - xi) Risk analysis,
   - xii) Consultancy services required, if any,
   - xiii) Cost estimates of the project:
     - a) *Soft costs* — Costs of consultancy, surveys, investigations, fees for obtaining approvals, overheads, miscellaneous expenditure, etc.
     - b) *Hard costs* — Cost of actual construction including development of site and external services.
   - xiv) Source of funding of the project and its timeliness with reference to requirement of cash flow.

3) *Techno-economic analysis* — This analysis gives an idea of benefits of the project and provides a platform for preparation of detailed project design.

4) *Project plan including scheme design* — It is the most important aspect of the project entity defining the sequence of each activity of the project in the form of network drawing. Once it has been determined that the project will continue, the design task should be completed in more detail. It involves detailing the basic programs, allocating tasks, determining resources and identifying the functions to be carried out along with their priorities. Technical requirements, such as skill wise manpower need, should be finalized at this stage. Upon completion of the scheme designs/drawings and specifications for construction of

facilities and equipment, operating plans and schedules along with contingency plans shall be prepared. It helps to identify project inputs, finance needed and cost benefit profile of the project.

   5) *Resource analysis* — It assesses and defines the inputs (material, machinery and human resources) required for each activity. It evaluates the feasibility of the project from the point of view of the availability of necessary resources. This aids in assessing the project cost.

g) *Financing and cost benefit analysis* — It involves estimating the project costs including cost of capital, opportunity cost, operating cost and fund requirements for comparing various project proposals on a common scale. It also provides a platform for investment decisions involving commitment of resources in future, with a long time horizon. Cost benefit analysis gives idea of benefits of the project and provides platform for preparation of detailed project design. The overall worth of a project is evaluated by considering the cost and benefits connected with the project.

   The financing plan should provide details about how any anticipated negative net cash flows will be financed during both the investment and operating stages of a project.Cost of missing opportunities for the same investment need to be considered for informed decision.

h) *Pre-Investment analysis* — The results obtained in previous stages are consolidated to arrive at clear conclusions. It helps the project sponsoring body, the project implementing body and the external consulting agencies to accept/reject the proposal.

5.4.3 The guiding principle during project formulation is to take a first look carefully and critically at the project idea by weighing its various components in-house with the assistance of specialists or consultants. It is an important stage for assessing the various aspects of the project. Initial project formulation shall be submitted in the form of report named as project formulation report.

5.5 Methodology

5.5.1 The preparation of preliminary plans shall be started considering all inputs from the field data, requirement of owner/client and stakeholders, and existing reports and studies conducted in the past on projects of similar type and nature. The various alternatives for implementation of project may be specified. The construction methodology for execution of project for each alternative shall be described. The resources (material, machinery, financial and human resources) needed during execution of project shall be defined in terms of source, their quantity and costs. The methodology and resource planning should also be given in the form of charts, giving clear picture of the same.

5.5.2 *Environmental Impact Assessment*

The environmental impact assessment of the project shall be made taking into account activities and construction items of project which have the potential for making an adverse impact on environment. The report on environmental impact assessment shall be clearly indicative of general assessment on current status of environment at the project location and its surrounding area, sensitivity level of environment, proposing methods to reduce adverse impact on natural conditions, elements of natural environment, health of community and relevant socio-economic factors, etc. This is all the more important when the site might have been contaminated due to earlier use and may need extensive treatment for remedial measures.

The social impact assessment of the project including resettlement problem, if any, shall also be projected.

5.5.3 *Cost Estimates*

The following components shall be considered while preparing the approximate cost estimates:

a) Capital cost for land procurement and its development.
b) Costs for site surveys, geotechnical investigations and other project site specific studies.
c) Cost of project and enabling buildings, roads, development of site and other infrastructure services.
d) Cost of engaging design professional and project management consultant.
e) Supervision cost including testing and inspections.
f) Fees for approval by municipal/development authorities.
g) Taxes as per law of the land.
h) Other costs chargeable to project such as insurance, essential items of furniture and fittings and equipment/appliances required to make project usable.
j) Cost of resettlement and rehabilitation of project affected people.
k) Financial costs and capital equipment cost.

The various types of resources required for each activity shall be determined including their quantum and timing and these requirements shall be converted into monetary terms. From the cost for carrying out various project activities, the estimated cost of obtaining the deliverables shall be worked out. Expected life of built assets and defect liability period suggested for the project, operation and maintenance costs have bearing on the costs and shall be accounted for. Acceptable levels of contingencies shall be added to account for unforeseen but essential expenses on the project. The cost estimates shall be based on current prevalent rates with suitable provisions made to allow for future escalation.

Detailed methodology for preparation of cost estimates given in **6.2** of IS 15883 (Part 3) may be adopted for working out cost estimates for project formulation purposes.

5.5.4 *Requisite Approvals*

The details of various approvals from municipal and other development bodies should also be listed specifying time frame and costs involved.

5.5.5 *Time Schedule — Activities to be Listed with Duration*

The various activities required to be carried out for the planning and execution of the project may be listed in sequence. In general, the list should indicatesome of the activities to be carried out in series. The list may also include activities which can be carried out in parallel, that is, simultaneously with other activities.

The time schedule for the planning and execution of the various items listed for the project may generally provide for the following major activities:

a) Acquisition of land.
b) Obtaining necessary approvals from statutory bodies.
c) Preparation of preliminary/scheme designs and estimates covering various components of the project.
d) Drawing up a sequence for execution of various components of the project, and the time required for each.
e) Where work is proposed to be carried out on contract, drawing up a sequence for call of tenders for various components at appropriate stages.
f) Resettlement and rehabilitation of project affected people.

5.6 Deliverables for Project Formulation

5.6.1 The work of project formulation shall culminate in preliminary project formulation report, which will broadly include the following:

a) Objectives of the project,
b) Salient features of the project,
c) Cost estimates and source of funds,
d) Preliminary project cost
e) Land for the project,
f) Feasibility report,
g) Preliminary quality and safety assurance plan,
h) Procurement strategy,
j) Project program and sequencing,
k) Mobilization and staffing requirement,
m) Statutory approvals required,
n) Economic and financial analysis, and
p) Conclusion and recommendations.

6 PROJECT APPRAISAL

6.1 General

Project appraisal entails review of project formulation proposal that is, verifying the basic data along with approach and methodology. The items for the review include project costing, project financing and different components of feasibility studies. Project costing may include project cash flow, time value for money, net present value, internal rate of return, payback period, practices of investment appraisal, analysis of risks, etc. Project financing may deal with means of financing, role of financial institutions, special schemes, key financial indicators, etc. Feasibility reports review may include adequacy of details, sufficiency of investigations and appropriate focus in draft project formulation report commensurate with the defined scope of work.

The project appraisal is the reassessment of various aspects of project formulation work described in the draft project formulation report justifying need for the project. It provides a comprehensive review of all aspects of the project and lays the foundation for implementing the project and evaluating it when completed. The factors for which the appraisal needs to be carried out are technical, institutional, economic, commercial and financial.

The project appraisal may be done by in-house expert team of the client or third party having sufficient experience in the related field.

6.2 Benefits of Project Appraisal

Project appraisal would help in the following way:

a) *Appraisal justifies spending money on a project* — Appraisal asks fundamental questions about funding requirement and whether a project offers good value for money. It can give confidence that money on the project is being put to good use, and help identify other funding to support the project.

b) *Appraisal is an important decision making tool* — Appraisal involves the comprehensive analysis of a wide range of data, decisions and assumptions, all of which need adequate evidence. This helps in assessing whether the project selected,
    1) will help the owner achieve its objectives.
    2) have been critically assessed such that project as conceived and formulated is deliverable.
    3) assess likely involvement of local people and benefits extended to them.
    4) are sustainable.
    5) have sensible ways of managing risk.
c) *Appraisal lays the foundations for delivery of the project* – Appraisal helps ensure,
    1) that projects will be properly managed by ensuring that appropriate financial and monitoring systems are employed;
    2) that there are contingency plans to deal with risks; and
    3) Setting milestones against which progress can be judged.

6.3 Objectives and Need

The main objectives of project appraisal are:

a) Justification of project.
b) Evaluation of technical soundness of the project.
c) Environmental impact assessment.
d) Ensuring realization of programme benefits as intended.
e) Verifying documentation to meet financial and audit requirements.
f) Value engineering to ensure that the project offers good value for money.
g) Review of energy consumption.
h) Examination of sustainability of project.
j) Involvement of stakeholders.

6.4 Activities Required for Project Appraisal

Project appraisal, whether carried out by owner/client or through consultant/third party appointed by the owner, shall involve,

a) verification of necessity of the project;
b) verification of basic data/ assumptions;
c) checking of approach and methodology;
d) review of cost estimates including value engineering;
e) environmental impact and sustainability;
f) review of financing;
g) review constructability aspect;
h) review of other resources;
j) review of organizational structure/ management aspects; and
k) views on viability of the project.

6.5 Methodology

The project may be examined by owner himself or got examined by consultant/third party from the technical, institutional/organizational/managerial, financial and economic point of view depending on nature of the project. The key criteria needing assessment shall be: relevance to the problem solving, feasibility of effectively achieving the project objectives and whether the project benefits will continue to flow during the project life cycle. On the basis of such an assessment, a decision shall be reached regarding technical soundness of the project, its financial justification and its viability from economic point of view.

The rationale behind the project appraisal is to provide the decision-makers with financial and economic yardsticks for the selection/rejection of projects from among competing alternative proposals for investment.

6.5.1 *Financial Techniques of Project Appraisal*

The techniques of project appraisal may be divided under two heads, namely undiscounted and discounted techniques.

Undiscounted techniques include payback period, and profit and loss account. Discounted techniques take into account the time value of money and include net present value (NPV), cost benefit ratio (CBR), internal rate of return (IRR), sensitivity analysis (treatment of uncertainty), and domestic resource cost (Modified Bruno Ratio). Different techniques for appraisal criteria are given at Annex B.

During the operating life of a project, it is very important to measure all costs and benefits comparing the difference between cost-benefit scenario without project and with project. Considerable care shall be taken in defining a base case which realistically sets out the profile of costs and benefits expected, if no additional investment is undertaken.

6.5.2 *Key Issues in Appraising Projects*

Key issues in the appraisal of a project shall include the following:

a) *Need, targeting and objectives* — The starting point for appraisal shall be to provide a detailed description of the project, identifying the need it aims to meet. Appraisal shall help show, if the project is the right response, and highlight the project objective and the intended beneficiaries.

b) *Context and connections* — Appraisal shall evaluate whether a project is consistent with the objectives of the relevant funding programme and with the aims of the stakeholders. It shall show, if there are links between the project and other local programmes/projects and whether it adds to such links or compete with the same.

c) *Consultation* — Local consultation may help determine priorities and secure community acceptability and identification with the project/ownership. More targeted consultation, with potential project users, may help ensure that project plans are viable. Appropriate consultation shall therefore be done; and the appraisal shall show whether the same has been done and how it has helped shape the project.

6.5.3 *Options Analysis*

Options analysis is concerned with establishing whether there are different ways of achieving objectives. Such different ways of meeting local need and key objectives shall be reviewed. This shall be done as follows:

a) *Inputs* — It is important to ensure that all the necessary people and resources are made available to deliver the project. This may require considering options for funding from various sources and other inputs. Appraisal should include the examination of appropriately detailed budgets, and life cycle costing wherever required.

b) *Outputs and outcomes* — Detailed consideration shall be given in appraisal of intended achievements of the project, that is, its outputs and its long-term outcomes. Appraisal shall consider benefits to neighbourhoods and their residents in terms of improved quality of life outcomes (jobs, better housing, safety, health, etc).Projects also produce outputs, and appraisal shall consider a more realistic view of output forecasts.

c) *Value engineering* — This is an important criteria against which projects are appraised, which is a major concern for the owner/client. It is also important for all stakeholders and it may be necessary to take into account the local factors, which may affect costs.

When moving forward in time to compute future values, analysts shall allow for the compounding of cash flows. Conversion of future values in terms of the present value, for comparison purposes, shall be done by discounting the same.

d) *Implementation* — Appraisal shall involve scrutinizing the practical plans for delivering the project, such as, adequacy of staffing, practicality of the timetable for the work, availability of adequate resources, and capability of the organization for delivering the project.

e) *Risk and uncertainty* — Appraisal shall carry out proper identification of risks, estimation of the scale of risks evaluation and mitigation of the risks to the project. There shall also be contingency plans to minimize the risk of project failure or a major gap between the intended and actual deliverables. The risks may be categorized as follows:

1) Market risk.
2) Financial and foreign exchange risk.
3) Government policy.
4) Resources.
5) Natural and manmade disasters.
6) Relationship between prices and quantities.
7) Technology risk.
8) Law and order.
9) Stakeholder resistance.

Forecasts used for market, technical, financial, economic and distributional analysis, are based on the prices of inputs and outputs, wages, rate of inflation, and exchange rate, etc, values of which cannot be ascertained with certainty over the life of project.

f) *Sensitivity analysis* — It identifies the parameters which are significant for the outcome of the project. These become risk variables. For each risk variable, a probability distribution and range of values shall be assigned. Correlations among variables shall also be built into the model. Finally, a Monte Carlo simulation shall be performed and the model results analysed. The risk analysis yields a distribution of results, such as expected values of the desired outcomes, the probability of negative returns and the variability of outcomes.

To manage a risk, a way shall be found to redesign or reorganize a project to reallocate risk efficiently. The solution is to reallocate risk to those parties who can best bear it.

- g) *Sustainability* — Sustainability appraisal shall include an assessment of environmental, social and economic impact of the project, with its positive and negative effects.

The appraisal shall encompass each of the above areas, with some of the areas being inter-linked. A realistic assessment of outputs shall be necessary for calculation of value for money. The final judgment shall depend on a balanced consideration of all these important factors.

6.6 Project Appraisal Outcome

6.6.1 *Important Features of Project Appraisal*

An appraisal system shall ensure that,

- a) project formulation, appraisal and approval functions are dealt with separately.
- b) all the relevant information is gathered for appraisal; those involved in appraisal have appropriate information, competence and training to make proper use of technical and other information gathered.
- c) original scope of work and intended benefits are adhered to.
- d) there are realistic allowances for time involved in project development and appraisal.
- e) decisions are within the powers of the implementing persons.
- f) there are appropriate arrangements for very small projects.
- g) there are appropriate arrangements for dealing with new technologies, or particularly risky projects.
- h) environmental clearances.
- j) statutory laws/regulations are complied with.

6.6.2 Project appraisal helps project initiators and designers to,

- a) be consistent and objective in choosing projects.
- b) ensure that desired benefits are achievable.
- c) ensure availability of documentation for financial and audit requirements.

6.7 Deliverables of Project Appraisal

The deliverables of project appraisal shall be as given below:

- a) *Verification of Basic Data/Assumptions Made for the Proposed Project, etc:*
  - 1) Verification of meeting the basic objectives of the project.
  - 2) Verification of basic data considered/assumptions made while drawing up the project.
  - 3) Verification of necessity of the proposed project.
  - 4) Verification of availability of land and its suitability and approvals required from government/local bodies.
- b) Review of project formulation report.
- c) *Technical Items:*
  - 1) Sufficiency of material and geotechnical investigations.
  - 2) Availability of external services.
  - 3) Suitability of scheme design.
  - 4) Availability of technical personnel/supervisory personnel/consultancy organization for planning and execution of the project.
- d) *Financial Appraisal* — A financial appraisal enables the project analyst to establish the financial sustainability of the project by identifying any financing shortfalls that are likely to occur during the investment and operating stages of the project. The financial cash flow statement of a project is a profile of the project receipts and expenditures over time. Financial analysis should be carried out from different points of view, that is, from the point of view of owner, all investors combined, budget, and other perspectives, such as, effect on other groups like competitors, suppliers of inputs and downstream processors. Following factors merit consideration:
  - 1) Cost of the project.
  - 2) Source of funding of the project and its timeliness with reference to requirement of cash flow.
  - 3) Role of financial institutions — urgency of payback period.
  - 4) Internal rate of return on investment made.
  - 5) Analysis of risks, etc.
- e) *Viability of the project* — Based on the verification of basic data/assumptions made for the proposed project, and the review of project formulation proposal, the owner may be in a position to come to a view whether the proposed project is viable and may be approved for detailed planning and execution.

  Criteria or results which may help to assess whether the project is viable, or can be made viable, shall be,
  - 1) technical,
  - 2) economical,
  - 3) financial, and
  - 4) social.

6.8 Checklist for Project Appraisal

The checklist may vary from project to project. It shall include the following:

a) Are appraisals systematic and disciplined with a clear sequence of activities and operating rules?

b) Is there an independent assessment of the project by someone who has not been involved with the development of the project?

c) Does the appraisal process culminate in clear recommendations that inform approval (or rejection) of the project?

d) Is the appraisal stage clearly distinct from project formulation?

e) Is the appraisal process well documented, with key documents signed, showing ownership and agreement, and allowing the appraisal documentation to act as a basis for future management, monitoring and evaluation?

f) Does the appraisal system comply with any relevant government guidance?

g) Are the right people involved at various stages of the process and, if necessary, how can involvement of people be widened?

After studying the alternate proposals, the most viable project proposal shall be selected and project proposal formulated and appraised in accordance with methodology outlined above. If the project is found to satisfy the criteria laid down by the owner/client by way of scope and meeting of the basic objectives and project is found to be viable, the project is approved for implementation. However, before the project implementation is taken up, a detailed project report (DPR) shall be prepared to have detailed technical study, evaluate actual resource requirements and prepare work schedules so as to ensure seamless operations and arrange for financial and other resources inputs. The investigations done, pre-feasibility report and feasibility reports shall form integral part of the DPR. Contents to be covered in a DPR for a typical project to be taken up are listed in Annex C and may be modified to suit specific projects.

A typical flow chart depicting various stages in the process of project formulation and appraisal is given in Fig. 2.

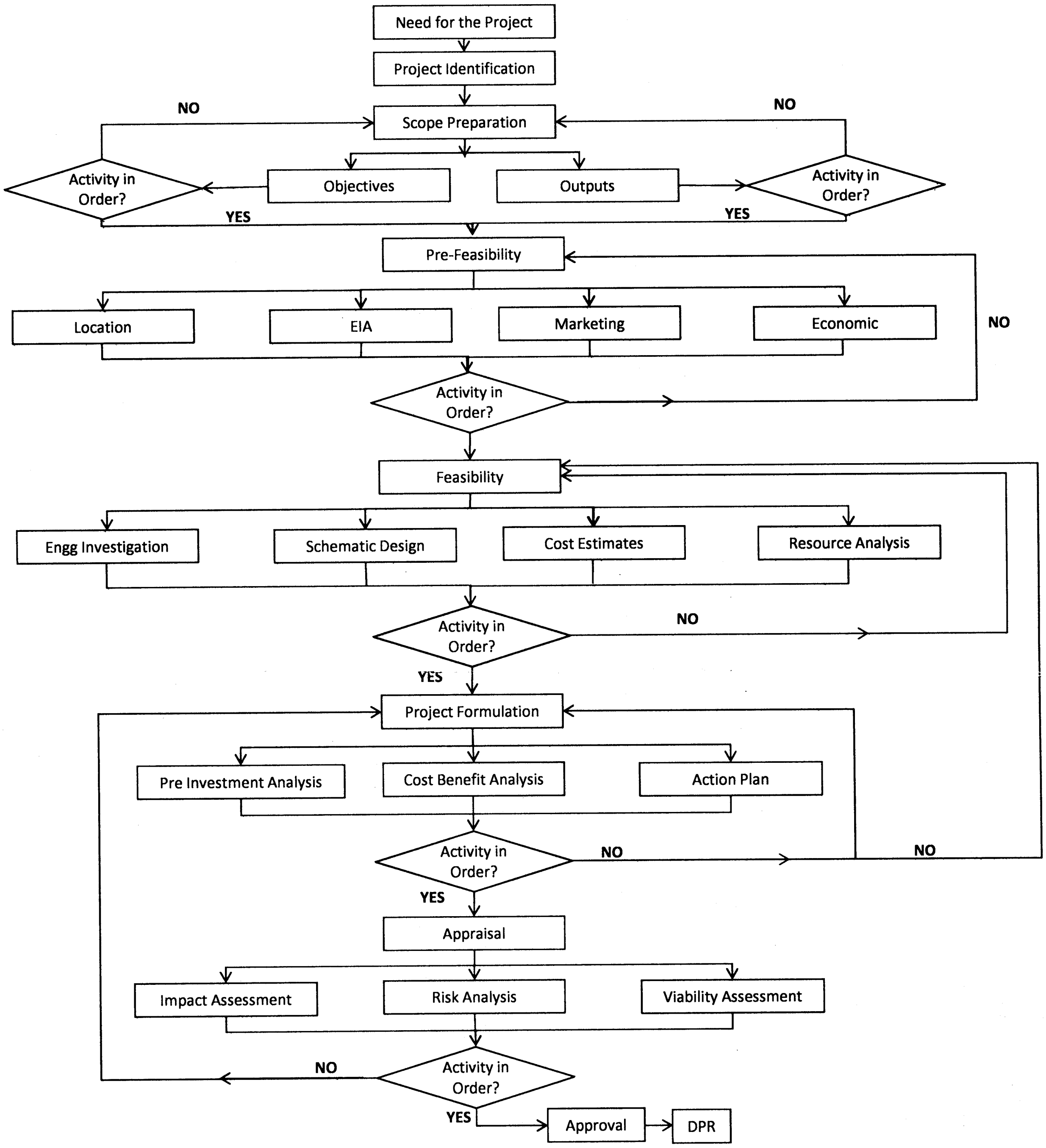


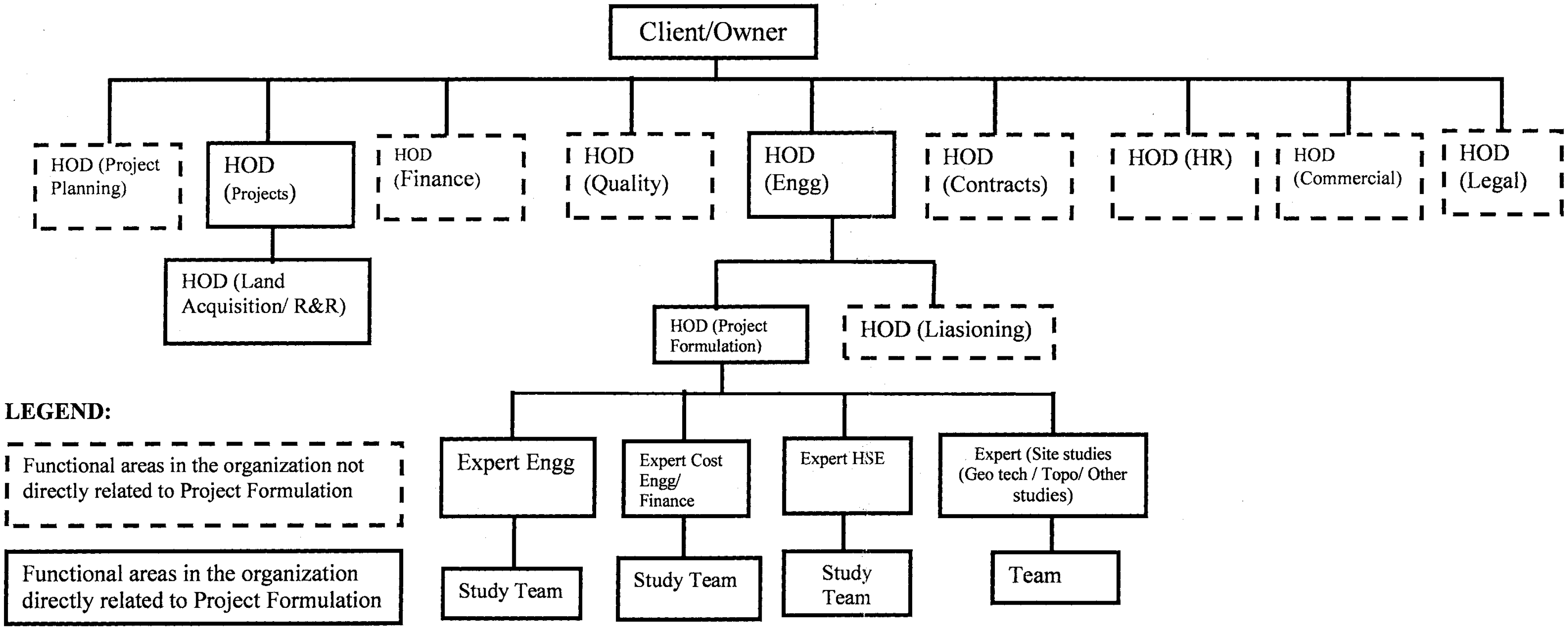
FIG. 2 DETAILED FLOW CHART FOR PROJECT FORMULATION AND APPRAISAL

ANNEX A

(*Clause* 4.3)

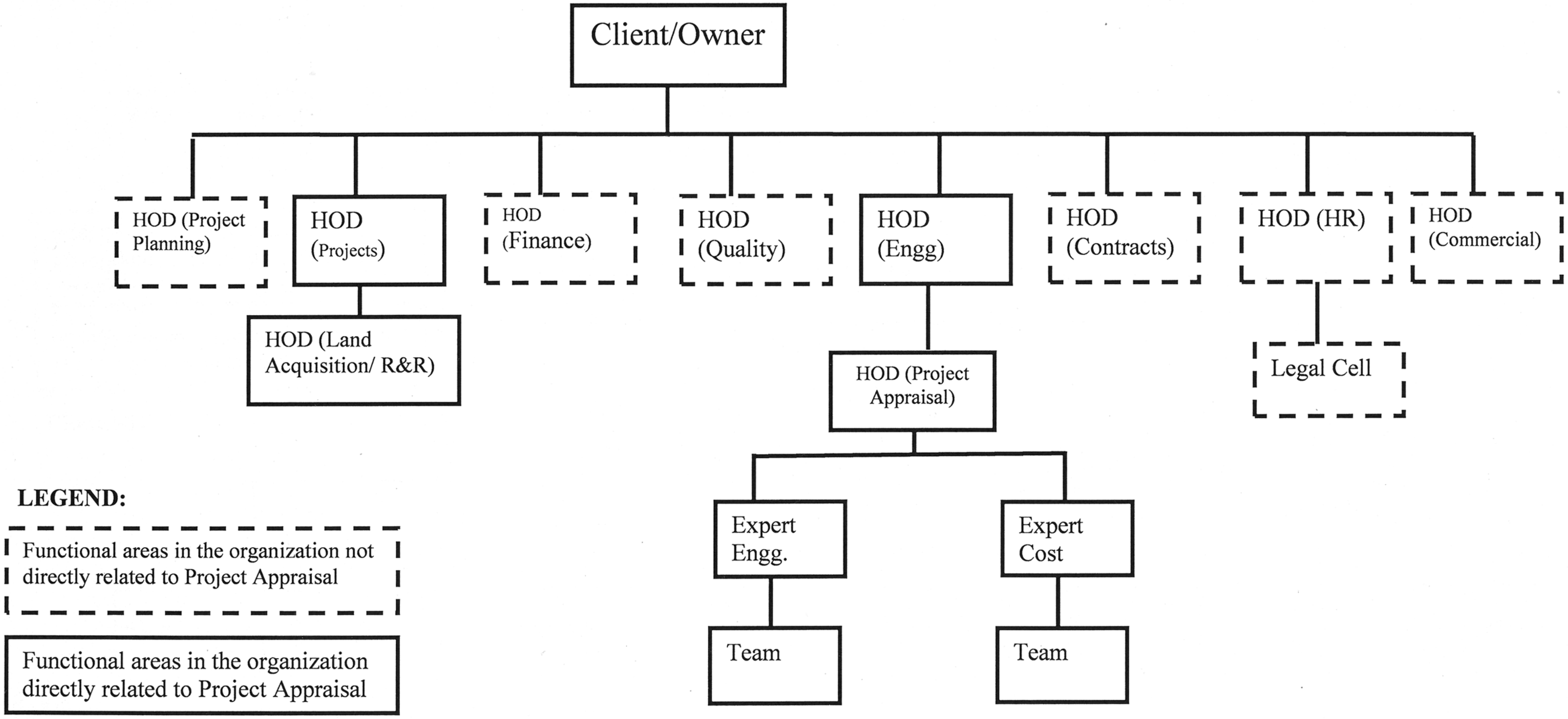
ORGANIZATION CHARTS

A-1 TYPICAL ORGANIZATION CHART (IN HOUSE-PROJECT FORMULATION)


Client/Owner
HOD (Project Planning)
HOD (Projects)
HOD (Finance)
HOD (Quality)
HOD (Engg)
HOD (Contracts)
HOD (HR)
HOD (Commercial)
HOD (Legal)
HOD (Land Acquisition/ R&R)
HOD (Project Formulation)
HOD (Liasioning)
LEGEND:
Functional areas in the organization not directly related to Project Formulation
Functional areas in the organization directly related to Project Formulation
Expert Engg
Expert Cost Engg/ Finance
Expert HSE
Expert (Site studies (Geo tech / Topo/ Other studies)
Study Team
Study Team
Study Team
Team

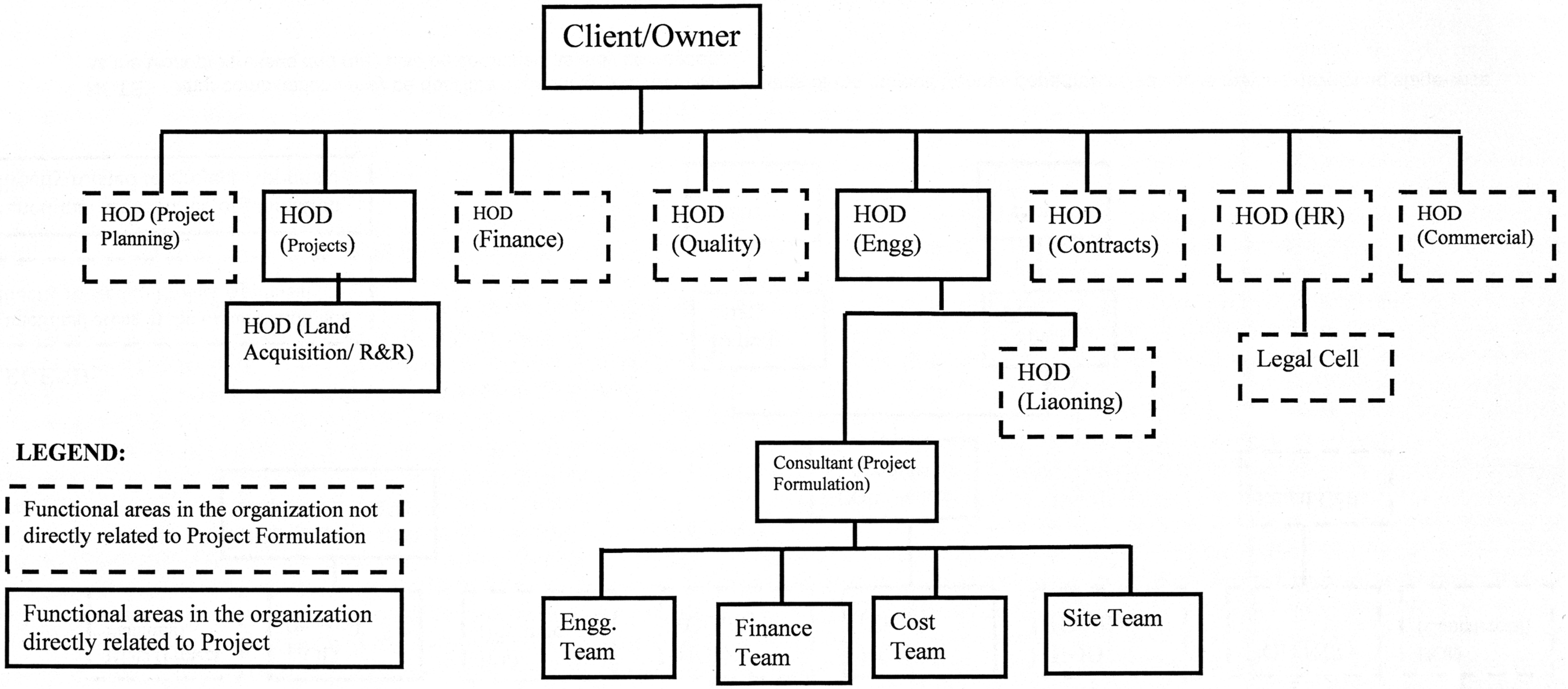
NOTE — Other combinations may be possible depending upon the requirements of the project. Various departments as above may be developed stage-wise as the work progresses and may also be combined as may be needed.

A-2 TYPICAL ORGANIZATION CHART (IN HOUSE-PROJECT APPRAISAL)



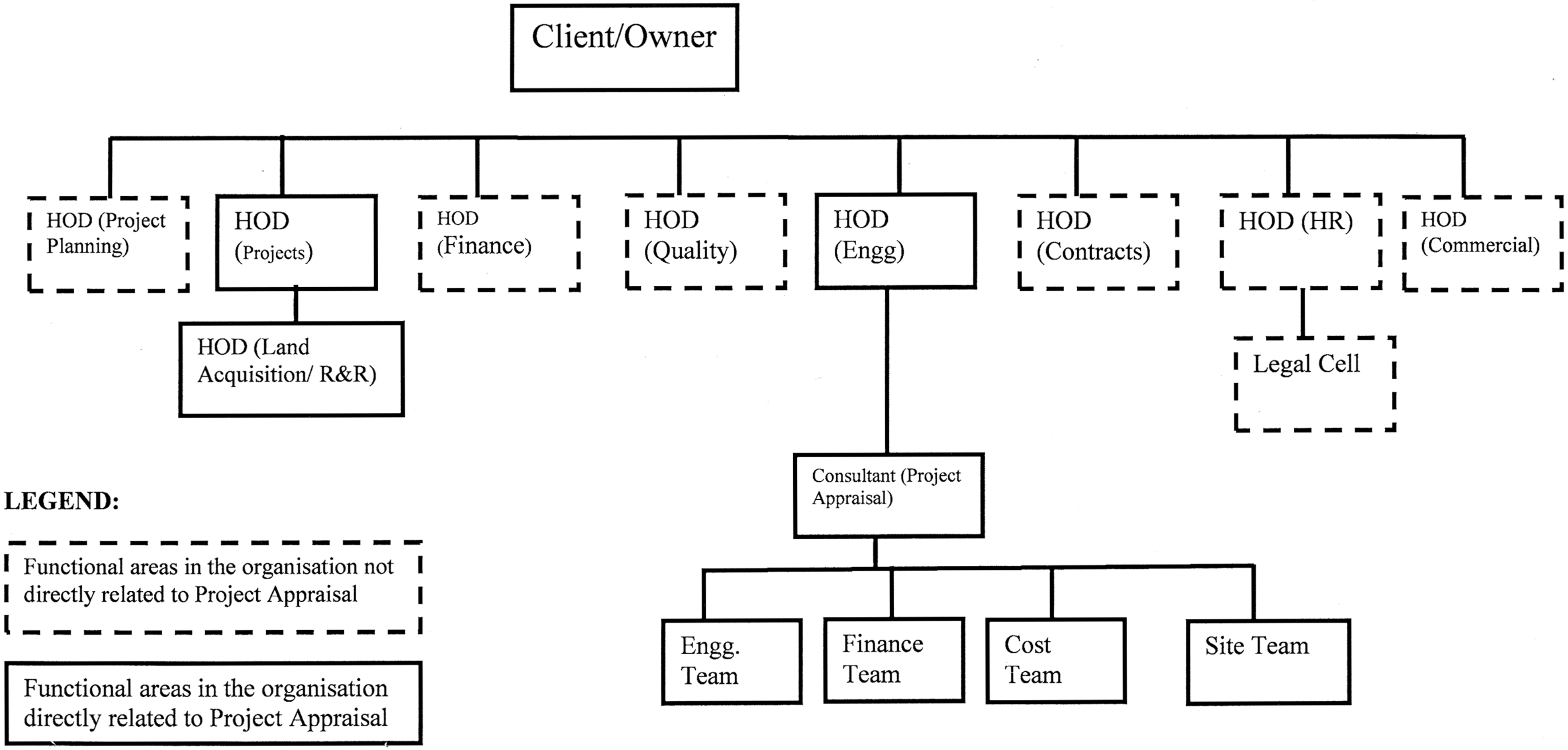
NOTE — Other combinations may be possible depending upon the requirements of the project. Various departments as above may be developed stage-wise as the work progresses and may also be combined as may be needed.

A-3 TYPICAL ORGANIZATION CHART (OUTSOURCE-PROJECT FORMULATION)


Client/Owner
HOD (Project Planning)
HOD (Projects)
HOD (Finance)
HOD (Quality)
HOD (Engg)
HOD (Contracts)
HOD (HR)
HOD (Commercial)
HOD (Land Acquisition/ R&R)
HOD (Liaoning)
Legal Cell
Consultant (Project Formulation)
Engg. Team
Finance Team
Cost Team
Site Team
LEGEND:
Functional areas in the organization not directly related to Project Formulation
Functional areas in the organization directly related to Project

NOTE — Other combinations may be possible depending upon the requirements of the project. Various departments as above may be developed stage-wise as the work progresses and may also be combined as may be needed.

A-4 TYPICAL ORGANIZATION CHART (OUTSOURCE-PROJECT APPRAISAL)


Client/Owner
HOD (Project Planning)
HOD (Projects)
HOD (Finance)
HOD (Quality)
HOD (Engg)
HOD (Contracts)
HOD (HR)
HOD (Commercial)
HOD (Land Acquisition/ R&R)
Legal Cell
Consultant (Project Appraisal)
Engg. Team
Finance Team
Cost Team
Site Team
LEGEND:
Functional areas in the organisation not directly related to Project Appraisal
Functional areas in the organisation directly related to Project Appraisal

NOTE — Other combinations may be possible depending upon the requirements of the project. Various departments as above may be developed stage-wise as the work progresses and may also be combined as may be needed.

ANNEX B

(*Clause* 6.5.1)

TECHNIQUES OF ECONOMIC APPRAISAL OF PROJECT

B-1 PAYBACK PERIOD

The payback period is the number of years it takes to payback the initial investment of a capital project from the cash flows that the project produces. For example, an investment of Rs 1 000 which returned Rs 400 per year would have a two and half year (1 000/400) payback period.

Payback Period Example 1:

Two mutually exclusive real estate investment proposals involving investment of Rs 100 Crore has net cash flow from lease rental income is as indicated in table below

(Amount in Rupees Crores)

Year	Investment	Cash flow of Proposal	
		A	B
0	100	—	—
1		50	10
2		40	15
3		30	20
4		25	25
5		20	30
6		15	40
7		10	50

Payback period for proposal A is 2⅓ years and for proposal B is 5 years. Investment decision would thus go in favour of proposal A if the payback criterion were to be applied in project selection.

This technique is easy to compute, easy to understand and provides some indication of risk by separating long-term projects from short-term projects. It doesn't measure profitability, doesn't account for the time value of money and ignores financial performance after the break-even period.

In nut shell payback period intuitively measures how long something takes to pay for itself. All else being equal, shorter payback periods are preferable to longer payback periods.

B-2 PROFIT AND LOSS ACCOUNT

This is a financial statement that summarizes the revenues, costs and expenses incurred during a specific period of time, usually a fiscal quarter or year. These records provide information that shows the ability of a company to generate profit by increasing revenue and reducing costs. The P&L statement is also known as a statement of profit and loss, an income statement or an income and expense statement.

The basic formula for the profit and loss statement is:

Revenues – Expenses = Net profit

P&L statements generally follow this format:

a) Revenues — Operating/variable expenses = Gross profit/Operating margin
b) Gross profit/Operating margin — Overhead/fixed expenses = Operating income
c) Operating income ± Other/Non-operating income or expense = Pre-tax income
d) Pre-tax income — Income tax = Net income after taxes

B-3 RATE OF RETURN (ROR) METHOD

Rate of return is the return realized (either cash profit or net profit after taxes including or excluding interest) in any one year on the total capital employed (investment + working capital) on the project. This is a very crude index used to measure the productivity of assets in providing returns to the investors. The method is used now mainly in making intra-industry comparisons in the ratio analysis of enterprises. This short-cut method of capital budgeting under certain conditions, result in reasonably good evaluation (may lead to the same accept-reject decision as the discounted cash flow method) but has severe shortcomings and cannot in general be expected to provide a sound basis for project evaluation and selection.

Discounted techniques take into account the time value of money and include the following:

a) Net Present Value (NPV),
b) Cost Benefit Ratio (CBR) or Benefit Cost Ratio (BCR),
c) Internal Rate of Return (IRR),
d) Sensitivity Analysis (treatment of uncertainty), and
e) Domestic Resource Cost (Modified Bruno Ratio).

B-3.1 Net Present Value (NPV)

NPV compares the value of an amount today to the value of that same amount in the future, taking inflation and returns into account. If the NPV of a prospective project is positive, it should be accepted. However, if NPV is negative, the project should probably be rejected because cash flows will also be negative.

When cash inflows are even,

$$\text{NPV} = \frac{R\left\{1-(1+i)^{-n}\right\}}{i} - \text{Initial Investment}$$

where

R = net cash inflow expected to be received each period,

i = required rate of return per period, and

n = number of periods during which the project is expected to operate and generate cash inflows.

NPV Example 1: Even Cash Inflows

Initial investment in a real estate project	= Rs 200 Crore
Rental returns, R	= Rs 5 Crore each month for 120 months
Rate, i	= 12 percent per annum or 1 percent per month i.e 0.01

Assume that the salvage value of the project is zero

$$\begin{aligned} \text{Net Present Value} &= [5 \times \{1 - 1 \div (1 + 0.01)^{120}\} \div 0.01] - 200 \\ &\approx [5 \times 69.7] - 200 \\ &\approx 348.5 - 200 \\ &\approx \text{Rs } 148.5 \text{ Crores} \end{aligned}$$

When cash inflows are uneven,

$$\text{NPV} = \frac{R_1}{(1+i)^1} + \frac{R_2}{(1+i)^2} + \frac{R_3}{(1+i)^3} + \ldots - \text{Initial Investment}$$

where

i = target rate of return per period,

R_1 = net cash inflow during the first period,

R_2 = net cash inflow during the second period,

R_3 = net cash inflow during the third period, and so on...

NPV Example 2: Uneven Cash Inflows

Initial investment = Rs 10 Crores

Cash inflows of R_1 = Rs 3.4 Crores, R_2 = Rs 4.07 Crores, R_3 = Rs 5.8 Crores and R4 = Rs 2.0 Crores at the end of first, second, third and fourth year, respectively.

At the end of the fourth year, the Building will be sold for Rs 4 Crores.

The present value of investment shall be calculated as follows if the discount rate is 18 percent.

PV Factors for year 1, 2, 3 and 4 are:

a) Year 1 = 1 ÷ $(1 + 0.18)^1$ ≈ 0.847 5
b) Year 2 = 1 ÷ $(1 + 0.18)^2$ ≈ 0.718 2
c) Year 3 = 1 ÷ $(1 + 0.18)^3$ ≈ 0.608 6
d) Year 4 = 1 ÷ $(1 + 0.18)^4$ ≈ 0.515 8

NPV to be calculated as below

Year	**1**	**2**	**3**	**4**
Net cash inflow	Rs 3.4 Crores	Rs 4.0 Crores	Rs 5.8 Crores	Rs 2.0 Crores
Salvage value				Rs 4 Crores
Total cash inflow	Rs 3.4 Crores	Rs 4.0 Crores	Rs 5.8 Crores	Rs 6.9 Crores
× Present value Factor	0.847 5	0.718 2	0.608 6	0.515 8
Present value of cash flows	Rs 2.8 Crores	Rs 2.9 Crores	Rs 3.5 Crores	Rs 3.55 Crores
Total PV of cash inflows	Rs 12.75 Crores			
(–) Initial Investment	(–) Rs 10 Crores			
Net present value	Rs 2.75 Crores			

NPV Example 3:

The NPV of the cash flows of the two proposals A and B of payback period example 1 can be computed manually as follows:

(Amount in Rupees Crores)

Year	**Capital Cost**	**Cash Flow of Proposal**		**Factor @12 Percent Discount Rate**	**PV of Cash Flow**	
		A	B		A	B
0	100	—	—	1.000 0		
1		50	10	0.892 6	44.63	8.93
2		40	15	0.797 2	31.89	11.96
3		30	20	0.711 9	21.36	14.24
4		25	25	0.635 5	15.89	15.89
5		20	30	0.567 4	11.35	17.02
6		15	40	0.506 6	7.60	20.26
7		10	50	0.452 3	4.52	22.62
Total	**10 000**	**190**	**190**		**137.23**	**110.91**

NPV of proposal A and B would thus be Rs 37.23 Crores and Rs 10.91 Crores assuming that investment in the zero$^{\text{th}}$ year is not discounted. The project with higher NPV is selected.

This method has the advantage of giving a direct measure of the rupees contribution to the stockholders but does not provide information regarding the project size.

B-3.2 Benefit Cost Ratio (BCR)

BCR is the ratio of discounted value of all benefits to the discounted value of all the costs (including social benefits and costs of a public sector project) at a chosen discount rate *k*. The formula for BCR would be:

$$BCR = \frac{\left\{\frac{B_1}{(1+k)}+\frac{B_2}{(1+k)^2}+.....+\frac{B_t}{(1+k)^t}\right\}}{\left\{\frac{C_1}{(1+k)}+\frac{C_2}{(1+k)^2}+.....+\frac{C_t}{(1+k)^t}\right\}}$$

The generalized formula for BCR would be:

$$= \frac{\sum_{t=1}^{N}\frac{B_t}{(1+k)^t}}{\sum_{t=1}^{N}\frac{C_t}{(1+k)^t}} = \frac{\sum_{t=1}^{N}\frac{B_t}{(1+k)^t}}{\sum_{t=1}^{N}\frac{C_t}{(1+k)^t}}$$

where

B_t = Benefit (revenue), in year t; and

C_t = Capital and operating/recurring cost, in year t.

Project is selected, if BCR > 1 and rejected, if BCR < 1. If BCR = 1, there will be no effect whether the project is selected or not.

In case BCR is determined by using discounting technique it would simply be a variation of NPV method. However, governments may sometimes use undiscounted benefit-cost ratio analysis to evaluate the desirability of initiating projects that have large social benefits and costs since such costs are difficult to quantify, especially over a large time span and there is some justification that the social discount rate should be very low or zero.

BCR Example:

Calculate the BCR @15 percent discount rate for initial Real estate investment of Rs 100 Crores each in three projects A, B and C yielding net rental income as follows:

(Amount in Rupees Crores)

Year	PV IF @15 percent	Net Cash flows of			Present Value of Cash flow		
		A	B	C	A	B	C
0	1.000	(–)100	(–)100	(–)100	(–)100	(–)100	(–)100
1	0.870	20	30	30	17.4	26.1	26.1
2	0.756	30	30	30	22.68	22.68	22.68
3	0.658	40	30	20	26.32	19.74	13.16
4	0.572	50	30	20	28.6	17.16	11.44
5	0.497	60	30	10	29.82	14.91	4.97

Column No.	A	B	C
Discounted value of benefits	124.82	100.59	78.35
Initial Investment	100	100	100
BCR	1.248 2	1.005 9	0.783 5

Project A with higher BCR gets selected.

B-3.3 Internal Rate of Return (IRR)

IRR is the discount rate at which NPV for the project will be zero.

Internal rate of return (IRR) is the interest rate at which the net present value of all the cash flows (both positive and negative) from a project or investment equals zero.

Internal rate of return is used to evaluate the attractiveness of a project or investment. If the IRR of a new project exceeds a company's required rate of return, that project is desirable. If IRR falls below the required rate of return, the project should be rejected.

The formula for IRR is:

When cash inflows are uneven the NPV is calculated with the following formula as explained above

$$\text{NPV} = \frac{R_1}{(1+i)^1}+\frac{R_2}{(1+i)^2}+\frac{R_3}{(1+i)^3}+\ldots - \text{Initial Investment}$$

where

i = IRR, if NPV is equal to zero in above formula,

R_1 = net cash inflow during the first period,

R_2 = net cash inflow during the second period,

R_3 = net cash inflow during the third period, and so on...

IRR value cannot be derived analytically. Instead, IRR must be found by using mathematical trial-and-error to derive the appropriate rate.

In the NPV Example 1 above if the value of i is kept as 35.15 percent, the NPV is approx. equal to zero, that is, IRR is 35.15 percent.

IRR Example

For NPV Example-3, the IRR may be computed as below:

Year	PV Interest Factors for Discount Rate					Cash flow of proposal, in Rupees Crores	
	10 percent	15 percent	20 percent	25 percent	30 percent	A	B
0	1.000 0	1.000 0	1.000 0	1.000 0	1.000 0	(–)100	(–)100
1	0.909 1	0.869 6	0.833 3	0.800 0	0.769 2	50	10
2	0.826 4	0.756 1	0.694 4	0.640 0	0.591 7	40	15
3	0.751 3	0.657 5	0.578 7	0.512 0	0.455 2	30	20
4	0.683 0	0.571 8	0.482 3	0.409 6	0.350 1	25	25
5	0.620 9	0.497 2	0.401 9	0.327 7	0.269 3	20	30
6	0.564 5	0.432 3	0.334 9	0.262 1	0.207 2	15	40
7	0.513 2	0.375 9	0.279 1	0.209 7	0.159 3	10	50

PV at various discount rates for proposal A and B and NPV is tabulated below:

Year	Proposal A					Proposal B				
	10 percent	15 percent	20 percent	25 percent	30 percent	10 percent	15 percent	20 percent	25 percent	30 percent
0	(–) 100	(–) 100	(–) 100	(–) 100	(–) 100	(–) 100	(–) 100	(–) 100	(–) 100	(–) 100
1	45.5	43.5	41.7	40.0	38.5	9.1	8.7	8.3	8.0	7.7
2	33.1	30.2	27.8	25.6	23.7	12.4	11.3	10.4	9.6	8.9
3	22.5	19.7	17.4	15.4	13.7	15.0	13.2	11.6	10.2	9.1
4	17.1	14.3	12.1	10.2	8.8	17.1	14.3	12.1	10.2	8.8
5	12.4	9.9	8.0	6.6	5.4	18.6	14.9	12.1	9.8	8.1
6	8.5	6.5	5.0	3.9	3.1	22.6	17.3	13.4	10.5	8.3
7	5.1	3.8	2.8	2.1	1.6	25.7	18.8	14.0	10.5	8.0
SUM Year (1-7)	144.1	127.9	114.7	103.8	94.6	120.5	98.5	81.8	68.9	58.8
NPV	44.1	27.9	14.7	3.8	–5.4	20.5	–1.5	–18.2	–31.1	–41.2

IRR = 25% + (5% /(103.8–94.6)) × 3.8 = 25% + 2.07% = 27.07%

IRR of Proposal A: NPV @ 25% = 3.8 and NPV @ 30% = (–) 5.4

IRR = 10% + (5% /(120.5 – 98.5)) × 20.5 = 10% + 4.66% = 14.66%

IRR of Proposal B: NPV @ 10% = 20.5 and NPV @ 15% = (–) 1.5

IRR is calculated based on extrapolation.

Project with higher IRR gets preference during selection.

B-3.4 Sensitivity Analysis (Treatment of Uncertainty)

Sensitivity analysis is an analysis that finds out how sensitive an output is to any change in an input while keeping other inputs constant.

In finance, it refers to an analysis of how each of the input variables in a capital budgeting decision (such as discount rate, cash flows growth rate, tax rate, etc.) affects the net present value, IRR or any other output while keeping other variables constant.

Sensitivity analysis is useful because it tells the model user how dependent the output value is on each input. It gives him an idea of how much room he has for each variable to go adverse. It helps in assessing risk.

Some of the advantages of sensitivity analysis include impressing management that there is a range of possible outcomes, decision making is more realistic, though perhaps more complex. And the relative importance of each variable examined is readily apparent. Some weaknesses are that variables are treated individually, limiting the extent to which combinations of variables can be assessed.

Sensitivity analysis is a quantitative risk analysis technique that involves analyzing the potential impact of risk on the project and filters risks with greatest potential. This is done by relative comparison of the uncertain elements while holding all other elements at their baseline values.

B-3.4.1 *Measurement of Sensitivity*

We conduct sensitivity analysis by an approach outlined below:

a) Find the base case output at the base case value of the input (i_1) for which we intend to measure the sensitivity. We keep all other inputs in the model constant

b) Find the value of output at a new value of the input (say i_2) while keeping other inputs constant.

c) Find the percentage change in the output and the percentage change in the input.

d) Find sensitivity by dividing the percentage change in output by the percentage change in input.

In second round, we test sensitivity for another input. We carry on this process till we get the sensitivity figure for each of the inputs. The higher the sensitivity figure, the more sensitive the output is to any change in that input and *vice-versa.*

Let output ‘O’= $(A+2B+3C)^2$

Input 1 (A)	Input 2 (B)	Input 3 (C)	Output ‘O’	Input percent change	Output percent change	Sensitivity Output/ Input
1	1	1	36	Base Case		
2	1	1	49	100	36.11	0.388
1	2	1	64	100	77.7	0.777
1	1	2	81	100	125	1.25

From the above it implies that output is most sensitive to input 3.

B-3.5 Domestic Resource Cost (Modified Bruno Ratio)

DRC is the cost in domestic currency required to earn a unit of foreign exchange through a proposed project. This concept compares the opportunity costs of domestic resources (primary factors such as labour, capital, land) committed to the extraction of natural resources like crude oil etc., with prices at which these natural resources can be exported or imported, the latter prices (the foreign exchange gained or saved) being considered as the ensuing benefits from production. The rationale for using the foreign exchange gained (through exports) or saved (through imports) as a standard of reference is that foreign exchange is relatively, and often critically, scarce in many developing countries. The project is accepted, if the domestic resource cost is less than the exchange rate in financial analysis.

Consider an economy which faces the question of whether it should locally extract the crude oil, or whether it should be imported from outside the country. The equilibrium exchange rate is assumed to be 1$ = Rs 60 Now suppose that the Crude Oil, if imported, costs the country $ 100 Crores (that is Rs 6 000 Crores when converted at the equilibrium exchange rate). In the alternative case of - extracting the crude oil locally, the country has to import International construction services for exploration and extraction at say $ 85 Crores (Rs 5 100 Crores), while using domestic labour and capital which cost, say, Rs 400 Crores. This means that a domestic value added of (6 000 – 5 100 – 400 = Rs. 500 Crores) Rs 500 Crores ($ 8.3 Crores) is generated through extracting the crude oil, which is lower than the international value added embodied in the crude oil import ($ 15 or Rs 900 Crores). Obviously, the extraction of crude oil locally would be efficient from a social point of view. Had the same amount of labour and capital cost the country, say, Rs 1 000 Crores (instead of Rs 500 Crores), which could be employed elsewhere, it would have been profitable for our country to import Crude oil and to shift the domestic resources to other activities in which it is a relatively more efficient in production *vis-a-vis* the rest of the world.

ANNEX C

(*Clause* 6.8)

DETAILED PROJECT REPORT – SAMPLE FORMAT

EXECUTIVE SUMMARY (SYNOPSIS OF REPORT)

1 INTRODUCTION

1.1 Project Background
1.2 Project Definition and Scope
1.3 Salient Features

2 SOCIO-ECONOMIC PROFILE

2.1 Overall Approach and Objective
2.2 General Features
2.3 Infrastructure
  A) *Present requirements including land*
  B) *Projection of future requirements*
2.4 Conclusions

3 ENGINERING SURVEYS AND INVESTIGATIONS

3.1 Topographic Survey
3.2 Geotechnical Investigation
3.3 Material Survey
3.4 Hydrological and Drainage Investigation
3.5 EXTERNAL SERVICES FOR DEVELOPMENT
  A) Already existing
  B) Additional/augmentation required at present
  C) Additional/augmentation required in future

4 APPROVALS

(A) *Statutory approvals*
(B) Other approvals

5 DESIGNS

5.1 Architectural Designs
5.2 Structural Designs
5.2 Designs Of Internal Services
5.3 Designs Of External Services

6 VALUE ENGINEERING

6.1 Introduction
6.2 Objective
6.3 Approach
6.4 Suggestions for Savings

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 Introduction
7.2 Methodology
7.3 Regulatory Framework
7.4 Anticipated Impacts
7.5 Potential Impacts and Mitigation Measures
7.6 Environmental Management Plan
7.7 Environmental Budget

8 SOCIAL IMPACT ASSESSMENT AND RESETTLEMENT PLAN

8.1 Introduction
8.2 Social Impact Assessment
8.3 Measures for Minimizing Resettlement
8.4 Resettlement Policies and Legal Framework
8.5 Public Consultation and Group Discussion
8.6 Magnitude of Impact on Properties and People
8.7 Mechanism of Income and Livelihood Restoration
8.8 Relief and Rehabilitation Budget
8.9 Institutions for Implementation of Resettlement Plan
8.10 Grievance Redress Mechanism
8.11 Monitoring And Evaluation System

9 COST ESTIMATE

9.1 General
9.2 Methodology
9.3 Unit Rate
9.4 Cost Components
9.5 Supervision Costs
9.6 Maintenance During Construction
9.7 Contingencies

10 PROJECT FRAMEWORK FOR IMPLEMENTATION

(A) Methodology
(B) Organizational structure
(C) Resource assessment & Deployment

11 PROJECT PHASING

11.1 Introduction
11.2 Project Package Size
11.3 Period(s) of Construction

12 PROJECT O & M PLANNING

13 PROJECT FINANCIAL VIABILITY & SUSTAINABILITY

- 13.1 Economic Analysis
- 13.2 Financial Analysis
- 13.3 Minimum Return Criteria
- 13.4 Model Adopted

14 CONCLUSION AND RECOMMENDATIONS

- 14.1 General
- 14.2 Package Size
- 14.3 Period of Construction
- 14.4 Land Acquisition
- 14.5 Project Cost
- 14.6 Result Of Financial Analysis
- 14.7 Model Adopted
- 14.8 Social Impact Assessment and Resettlement Action Plan
- 14.9 Compliances

15 ANNEXES

- ANNEX A PROJECT FORMULATION REPORT
- ANNEX B PROJECT APPRAISAL REPORT

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

Construction Management (Including Safety in Construction) Sectional Committee, CED 29

Organization	*Representative(s)*
In Personal Capacity (*103, CharakSadan, Vikaspuri, New Delhi*)	Shri P. Krishnan (***Chairman***)
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